

Claims:

1. A method of producing additive and monochrome color images from a stacked chiral nematic liquid crystal display, comprising:

5 passing incident light into a first layer of the display, said first layer comprising first chiral nematic liquid crystal material, the liquid crystal of said first material having positive dielectric anisotropy and a pitch length effective to reflect visible light of a first color;

10 electrically addressing said first layer to reflect visible light from the display of said first color by transforming a portion of the liquid crystal of said first layer into a reflective twisted planar texture;

15 passing said incident light through said first layer into a second layer of the display stacked relative to said first layer, said second layer comprising second chiral nematic liquid crystal material, the liquid crystal of said second material having positive
20 dielectric anisotropy and a pitch length effective to reflect visible light of a second color;

 electrically addressing said first layer and said second layer to reflect visible light from the display of said second color by transforming a portion of
25 the liquid crystal of said second layer into the reflective twisted planar texture and a portion of the liquid crystal of said first layer into the focal conic texture; and

30 electrically addressing said first layer and said second layer to reflect visible light from the display of a color that is additive of said first color said second color by transforming portions of the liquid crystal of said first layer and said second layer into the reflective twisted planar texture.

2. The method of claim 1 comprising:

passing said incident light through said first layer, through said second layer and into a third layer of the display stacked relative to said first layer and said second layer, said third layer comprising third chiral nematic liquid crystal material, the liquid crystal of said third material having positive dielectric anisotropy and a pitch length effective to reflect visible light of a third color;

electrically addressing said first layer, said second layer and said third layer to reflect visible light from the display of said third color by transforming a portion of the liquid crystal of said third layer into the reflective twisted planar texture and a portion of the liquid crystal of said first layer and said second layer into the focal conic texture;

electrically addressing said first layer, said second layer and said third layer to reflect visible light from the display of a color that is additive of said third color and said second color by transforming portions of the liquid crystal of said third layer and said second layer into the reflective twisted planar texture and a portion of the liquid crystal of said first layer into the focal conic texture;

electrically addressing said first layer, said second layer and said third layer to reflect visible light from the display of a color that is additive of said third color and said first color by transforming portions of the liquid crystal of said third layer and said first layer into the reflective twisted planar texture and a portion of the liquid crystal of said second layer into the focal conic texture; and

electrically addressing said first layer, said second layer and said third layer to reflect visible light from the display of a color that is additive of said first color, said second color and said third color by transforming portions of the liquid crystal of said

first layer, said second layer and said third layer into the reflective twisted planar texture.

3. A method of producing additive color images from a stacked chiral nematic liquid crystal display, comprising:

5 passing incident light into a first layer and a second layer of the display, said first layer and said second layer being stacked relative to one another, said first layer comprising first chiral nematic liquid crystal material having a pitch length effective to reflect visible light of a first color and said second
10 layer comprising second chiral nematic liquid crystal material having a pitch length effective to reflect visible light of a second color, the liquid crystal of said first material and said second material having positive dielectric anisotropy;

15 wherein incident light travels in a direction sequentially through said first region and said second region, said first region being closest to a viewer, comprising a light absorbing layer disposed downstream of said second region relative to said direction of incident
20 light;

 absorbing said incident light passing through said first region and said second region with said light absorbing back layer;

25 electrically addressing said first layer and said second layer to reflect visible light from the display of one of said first color and said second color by transforming a portion of the liquid crystal of one of said first layer and said second layer into a reflective planar texture; and

 electrically addressing said first layer and said second layer to reflect visible light from the display of color that is additive of said first color and said second color by transforming portions of the liquid crystal of said first layer and said second layer into the planar texture.

4. A method of producing additive color images from a stacked chiral nematic liquid crystal display, comprising:

5 passing incident light into a first layer, a second layer and a third layer of the display, said first layer, said second layer and said third layer being stacked relative to one another, said first layer comprising first chiral nematic liquid crystal material having a pitch length effective to reflect visible light of a first color, said second layer comprising second chiral nematic liquid crystal material having a pitch length effective to reflect visible light of a second color and said third layer comprising third chiral nematic liquid crystal material having a pitch length effective to reflect visible light of a third color, the liquid crystal of said first material, said second material and said third material having positive dielectric anisotropy;

20 wherein incident light travels in a direction sequentially through said first region, said second region and said third region, said first region being closest to a viewer, comprising a light absorbing layer disposed downstream of said third region relative to said direction of incident light;

25 absorbing said incident light passing through said first region, said second region and said third region with said light absorbing back layer;

30 electrically addressing said first layer, said second layer and third layer to reflect visible light from the display of one of said first color, said second color and said third color by transforming a portion of the liquid crystal of one of said first layer, said second layer and said third layer into the planar texture; and

35 electrically addressing said first layer, said second layer and said third layer to reflect visible

light from the display of a color that is additive of said first color, said second color and said third color by transforming portions of the liquid crystal of said first layer, said second layer and said third layer into the planar texture.

5. A reflective liquid crystal display device comprising:

first chiral nematic liquid crystal material comprising liquid crystal having a pitch length effective to reflect visible light of a first color, second chiral nematic liquid crystal material comprising liquid crystal having a pitch length effective to reflect visible light of a second color, and third chiral nematic liquid crystal material comprising liquid crystal having a pitch length effective to reflect visible light of a third color, the liquid crystal of said first material, said second material and said third material having positive dielectric anisotropy;

planar substrates that form therebetween a first region in which said first material is disposed, a second region in which said second material is disposed and a third region in which said third material is disposed, wherein said first region, said second region and said third region are stacked relative to each other and each of said first material, said second material and said third material extends continuously from near one of said substrates to near an adjacent one of said substrates;

wherein said substrates cooperate with said first material, said second material and said third material to form in said first region, said second region and said third region, scattering focal conic and reflecting planar textures that are stable in the absence of a field;

wherein incident light travels in a direction sequentially through said first region, said second region and said third region, said first region being

closest to the viewer, comprising a light absorbing back layer disposed downstream of said third region relative to said direction of incident light;

35 wherein the incident light is reflected by the planar textures of said first region, said second region and said third region such that reflected light leaving the display exhibits a color that is an additive mixing of combinations of said colors which are reflected from
40 said planar textures, and said incident light passing through said first region, said second region and said third region is absorbed by said light absorbing back layer; and

45 a first and second set of spaced apart electrodes bounding at least a portion of the first material in the first region, a third and fourth set of spaced apart electrodes bounding at least a portion of the second material in the second region, a fifth and sixth set of spaced apart electrodes bounding at least a portion of
50 the third material in the third region, drive circuitry electrically coupled to the first, second, third, fourth, fifth and sixth sets of electrodes for applying selected voltages to one or more of the first, second, third, fourth, fifth and sixth sets of electrodes for
55 transforming at least a portion of the liquid crystal of at least one of said first material, said second material and said third material, to at least one of the scattering focal conic and reflecting planar textures.

5 6. The reflective liquid crystal display device of claim 5 wherein the drive circuitry includes two drive circuits, the first drive circuit being electrically connected to the first set and second set of electrodes and the second drive circuit being electrically connected to the third and fourth sets of electrodes.

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7. The reflective liquid crystal display device of claim 5 wherein the first and second sets of electrodes are substantially orthogonal to each other, the third and fourth sets of electrodes are substantially orthogonal to each other, and the fifth and sixth sets of electrodes are substantially orthogonal to each other.